Form factor decomposition of generalized parton distributions at leading twist

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Abstract

We extend the counting of generalized form factors presented in PRD**63**(2000) by Ji and Lebed to the axial vector and the tensor operator at twist-2 level. Following this, a parameterization of all higher moments in x of the tensor (helicity flip) operator is given in terms of generalized form factors.

1 Counting generalized form factors

Generalized parton distributions still attract increasing interest among theorists and experimentalists alike investigating the quark and gluon structure of hadrons. For a complete description of the nucleon structure at (leading) twist 2 level, full knowledge of the corresponding spin independent (vector) GPDs $H(x,\xi,t)$ and $E(x,\xi,t)$ [1], the spin dependent (axial vector) GPDs $\widetilde{H}(x,\xi,t)$ and $\widetilde{E}(x,\xi,t)$ [1] as well as the transversity (tensor, helicity-flip) GPDs[1] $H_T(x,\xi,t)$,$E_T(x,\xi,t)$, $\widetilde{H}_T(x,\xi,t)$ and $\widetilde{E}_T(x,\xi,t)$ [2, 3] is necessary. In numerous cases, however, not the GPDs themselves, but their Mellin moments in x are needed, see e.g. the recent calculations of moments of GPDs in lattice QCD [4, 5, 6]. General higher Mellin moments of (matrix elements of) bilocal operators lead to towers of local operators, which in turn are parameterized in terms of generalized form factors (GFFs). The correct counting of the number of independent generalized form factors is quite important as a cross check of these parameterizations, as can be seen e.g. from the mistaken application of time reversal in the case of the helicity flip GPDs, see Ref. [3], which lead initially to a wrong number of GPDs but has since then been corrected in

[1]since $H_T(x,\xi\to 0,t\to 0)=h_1(x)=\delta q(x)$, we will denote H_T also as *generalized transversity*

[2]. Concerning the counting we will follow here closely the idea presented in Ref. [7] where it has been explicitely worked out for the vector operator. There it is suggested that instead of studying off-forward matrix elements like

$$\langle P'|\, \bar{\psi}(0)\Gamma iD^{\{\mu_1} iD^{\mu_2} \cdots iD^{\mu_n\}}\psi(0)\, |P\rangle = a_\Gamma^{\mu_1\cdots\mu_n} A(t) + b_\Gamma^{\mu_1\cdots\mu_n} B(t) + \cdots \tag{1}$$

under parity and time reversal in order to figure out in particular the number of independent generalized form factors $A, B, \ldots$, one switches to the crossed channel and considers the matrix-element

$$\left\langle P\bar{P}\right|\, \bar{\psi}(0)\Gamma iD^{\{\mu_1} iD^{\mu_2} \cdots iD^{\mu_n\}}\psi(0)\, |0\rangle \tag{2}$$

Here and in the following $D = \overleftrightarrow{D} = 1/2(\overrightarrow{D} - \overleftarrow{D})$, while $\{\}$ stands for symmetrization. This procedure reduces the counting to a matching of the J^{PC}-quantum numbers of the nucleon-antinucleon state $\left\langle P\bar{P}\right|$ and the state given by $\bar{\psi}(0)\Gamma iD^{\{\mu_1} iD^{\mu_2} \cdots iD^{\mu_n\}}\psi(0)\, |0\rangle$. We will see below, however, that the number of GFFs depends on the operator (i.e. Γ), and that the statement made in the last sentence of [7] that "...the number of form factors of a twist-2, spin-n operator is $n+1$ for nucleon states." is wrong or at least misleading.

After having done the counting for the tensor operator $\Gamma \widehat{=} i\sigma^{\mu\nu}$ (see table (14) and below), we finally construct the parametrization of the corresponding tower of local operators in terms of the the generalized form factors $A_{Tni}(t), \widetilde{A}_{Tni}(t), B_{Tni}(t)$ and $\widetilde{B}_{Tni}(t)$, Eq. (22).

1.1 Nucleon-antinucleon states

To get a list of the $P\bar{P}$-states we can e.g. follow the standard textbook discussion of the (para-,ortho-)positronium states. The allowed $\left\langle P\bar{P}\right|$-states ($P = (-)^{L+1}, C = (-)^{L+S}$) with $J = |L-S|, \ldots, L+S$ are

$S = 0$

J^{PC}	0^{-+}	1^{+-}	2^{-+}	3^{+-}	$\cdots$
L	0	1	2	3	$\cdots$

$S = 1$

J^{PC}	0^{++}	1^{--}	1^{++}	2^{--}	2^{++}	3^{--}	3^{++}	$\cdots$
L	1	0, 2	1	2	1, 3	2, 4	3	$\cdots$

(3)

The in principle accessible 0^{--}-state is forbidden.

The following discussion is based in parts on Ref. [8] and Ref. [9]. Representations of the Lorentz group are denoted by (A, B). The spin j runs from $j = |A-B|, \ldots, A+B$.

1.2 Vector operator

As a warm-up exercise we summarize in this section the main findings of Ref. [7]. The operator $v^\mu = \bar{\psi}(0)\gamma^\mu\psi(0)$ corresponds to the $\left(\frac{1}{2}, \frac{1}{2}\right)$ representation, with two possible values of j, $j = 0, 1$.

Here, $j = 0$ corresponds to the time-component v^0, while $j = 1$ corresponds to the spatial-components $v^{i=1...3}$. This gives the J^{PC}s 1^{--} and 0^{+-}. The more general tower of operators

$$\bar{\psi}(0)\gamma^{\{\mu} iD^{\mu_1} iD^{\mu_2} \cdots iD^{\mu_n\}}\psi(0) \tag{4}$$

corresponds to

$$\left(\frac{n+1}{2}, \frac{n+1}{2}\right), \tag{5}$$

with $j = 0, 1, \ldots, n+1$. Here and in the following the subtraction of traces is implicit. The C-parity is definite (independent of $\mu, \mu_1 \ldots$ being 0 or spatial) and given by $C = (-)^{n+1}$. The different values of j correspond to the individual indices $\mu, \mu_1 \ldots$ being 0 or spatial (e.g. the case in which all indices are spatial corresponds to the maximal j), and the parity is therefore dependent on j and given by $P = (-)^j$ $(\hat{P}D^0\hat{P}^{-1} = D^0, \hat{P}D^i\hat{P}^{-1} = -D^i)$. This results in the angular momentum decomposition

$$J^{PC} = j^{(-)^j(-)^{n+1}} = 0^{(+)(-)^{n+1}}, 1^{(-)(-)^n} \ldots, (n+1)^{(-)^{n+1}(-)^{n+1}}. \tag{6}$$

A matching with the possible $\langle P\bar{P}|$-states gives the number of available "channels", which is equal to the number of generalized form factors

$n\backslash J$	0	1	2	3	4	$\cdots$	# of GFFs
0	0^{+-}	$1^{--}_{0,2}$					2
1	0^{++}_1	1^{-+}	$2^{++}_{1,3}$				3
2	0^{+-}	$1^{--}_{0,2}$	2^{+-}	$3^{--}_{2,4}$			4
3	0^{++}_1	1^{-+}	$2^{++}_{1,3}$	3^{-+}	$4^{++}_{3,5}$		5
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$

(7)

The subscripts denote the allowed values of L. We find $n+2$ independent generalized form factors, as has been already shown in Ref. [7] (note that our n differs from that in [7]).

1.3 Axial vector operator

The discussion of the axial vector operator $a^\mu = \bar{\psi}(0)\gamma_5\gamma^\mu\psi(0)$ is essentially equal to that of the vector operator (see above), only the parity and charge conjugation properties are different. For a^μ we have again the two possible values $j = 0, 1$, with J^{PC} this time given by 1^{++} and 0^{-+}. The tower of operators

$$\bar{\psi}(0)\gamma_5\gamma^{\{\mu} iD^{\mu_1} iD^{\mu_2} \cdots iD^{\mu_n\}}\psi(0) \tag{8}$$

can be decomposed into $j = 0, 1, \ldots, n+1$ angular momentum components. Their charge parity is $C = (-)^n$. The parity depends on j and is given by $P = (-)^{j+1}$ (the maximal $j = n+1$ corresponding to $n+1$ spatial indices has parity $P = (-)^n$), so that

$$J^{PC} = j^{(-)^{j+1}(-)^n} = 0^{(-)(-)^n}, 1^{(+)(-)^n}, \ldots, (n+1)^{(-)^n(-)^n}. \tag{9}$$

Matching with the $\langle P\bar{P}|$-states we find

$$\begin{array}{|l|l|l|l|l|l|l|l|}\hline n\backslash J & 0 & 1 & 2 & 3 & 4 & \cdots & \# \\ \hline 0 & 0_0^{-+} & 1_1^{++} & & & & & 2 \\ \hline 1 & 0^{--} & 1_1^{+-} & 2_2^{--} & & & & 2 \\ \hline 2 & 0_0^{-+} & 1_1^{++} & 2_2^{-+} & 3_3^{++} & & & 4 \\ \hline 3 & 0^{--} & 1_1^{+-} & 2_2^{--} & 3_3^{+-} & 4_4^{--} & & 4 \\ \hline \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ \hline \end{array}. \tag{10}$$

This shows that there are $2\left\lfloor \frac{n}{2}\right\rfloor + 2$ independent generalized form factors, which is in perfect agreement with the explicit parameterization in Ref. [10] (see also Eq. (17) below).

1.4 Tensor operator

The discussion of the (antisymmetric) tensor operator $t^{\mu\nu} = \bar{\psi}(0) i\sigma^{\mu\nu}\psi(0)$ differs from that of v^μ and a^μ. The tensor operator $t^{\mu\nu}$ corresponds to the representation $(1,0)\oplus(0,1)$, therefore only $j=1$ is possible. The charge conjugation is $C=-$. The two cases t^{0i} and t^{ik}, both corresponding to $j=1$, have a different parity, $P=-$ respectively $P=+$. This leads to the two different J^{PC} components 1^{--} and 1^{+-}. In the case of the tower of operators

$$\underset{[\mu\nu]}{A}\;\underset{\{\nu\mu_1\ldots\}}{S}\;\bar{\psi}(0) i\sigma^{\mu\nu} iD^{\mu_1} iD^{\mu_2}\cdots iD^{\mu_n}\psi(0) \tag{11}$$

we first have to symmetrize and then antisymmetrize as indicated [8]. This tower corresponds to the $\left(\frac{n+2}{2},\frac{n}{2}\right)\oplus\left(\frac{n}{2},\frac{n+2}{2}\right)$ representation, i.e. $j=1,\ldots,n+1$. Again, the charge conjugation is definite and given by $C=(-)^{n+1}$. In contrast, the parity does not only depend on j, but for a given j there exist in addition two possibilities corresponding to an even or an odd number of spatial indices, as we have already seen for $t^{\mu\nu}$. This leads to the two sequences

$$J^{PC} = j^{(-)^{j+1}(-)^{n+1}} = 1^{(+)(-)^{n+1}}, 2^{(-)(-)^{n+1}}, \ldots, (n+1)^{(-)^n(-)^{n+1}} \tag{12}$$

and

$$J^{PC} = j^{(-)^{j}(-)^{n+1}} = 1^{(-)(-)^{n+1}}, 2^{(+)(-)^{n+1}}, \ldots, (n+1)^{(-)^{n+1}(-)^{n+1}}. \tag{13}$$

The matching with the $\langle P\bar{P}|$-states gives

$$\begin{array}{|l|l|l|l|l|l|l|}\hline n\backslash J & 1 & 2 & 3 & 4 & \cdots & \# \\ \hline 0 & 1_{0,2}^{--} & & & & & 2 \\ \hline 1 & 1^{-+} & 2_{1,3}^{++} & & & & 2 \\ \hline 2 & 1_{0,2}^{--} & 2^{+-} & 3_{2,4}^{--} & & & 4 \\ \hline 3 & 1^{-+} & 2_{1,3}^{++} & 3^{-+} & 4_{3,5}^{++} & & 4 \\ \hline \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ \hline \end{array}\quad \begin{array}{|l|l|l|l|l|l|l|}\hline n\backslash J & 1 & 2 & 3 & 4 & \cdots & \# \\ \hline 0 & 1_1^{+-} & & & & & 1 \\ \hline 1 & 1_1^{++} & 2_2^{-+} & & & & 2 \\ \hline 2 & 1_1^{+-} & 2_2^{--} & 3_3^{+-} & & & 3 \\ \hline 3 & 1_1^{++} & 2_2^{-+} & 3_3^{++} & 4_4^{-+} & & 4 \\ \hline \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ \hline \end{array} \tag{14}$$

corresponding to a total of $2\left\lfloor \frac{n}{2}\right\rfloor + n + 3 = 3, 4, 7, 8, 11, 12, \ldots$ generalized form factors.

2 Parameterizations

The decomposition of a matrix element like (1) in terms of calculable (pre-)factors given by spinor products times GFFs is not unique. One can always rewrite the spinor products using generalized Gordon identities [2], thereby going from one set of linear independent GFFs to another. Once such a set of real-valued form factors for the lowest moment has been found (under guidance of parity $\widehat{P}$ and time reversal $\widehat{T}$), the parameterization of the higher moments corresponding to the inclusion of covariant derivatives $iD^{\mu_1}\cdots iD^{\mu_n}$ is essentially constructed by introducing additional factors $\overline{P}^{\mu_i}(=(P'^{\mu_i}+P^{\mu_i})/2)$ and/or $\Delta^{\mu_i}\Delta^{\mu_j}$ ($\Delta^{\mu_i}=P'^{\mu_i}-P^{\mu_i}$) to the initial (lowest moment) decomposition, respecting the $\widehat{P}$ and $\widehat{T}$ properties of the covariant derivatives.

Before presenting the parameterization of the tower of operators involving $i\sigma^{\mu\nu}$ (related to the generalized transversity), let us first show for convenience the already known results for the vector and the axial vector case.

2.1 Vector operator

The decomposition for this case has been presented in Ref. [11] and is given by

$$\begin{aligned}\langle P'|\,\bar{\psi}(0)\gamma^{\{\mu}iD^{\mu_1}\cdots iD^{\mu_n\}}\psi(0)\,|P\rangle \;=\; & \overline{U}(P')\left[\sum_{\substack{i=0\\ \text{even}}}^{n}\left\{\gamma^{\{\mu}\Delta^{\mu_1}\cdots\Delta^{\mu_i}\overline{P}^{\mu_{i+1}}\cdots\overline{P}^{\mu_n\}}A_{n+1,i}(\Delta^2)\right.\right.\\ & \left.-i\frac{\Delta_\alpha\sigma^{\alpha\{\mu}}{2m}\Delta^{\mu_1}\cdots\Delta^{\mu_i}\overline{P}^{\mu_{i+1}}\cdots\overline{P}^{\mu_n\}}B_{n+1,i}(\Delta^2)\right\}\\ & \left.+\frac{\Delta^{\mu}\cdots\Delta^{\mu_n}}{m}C_{n+1,0}(\Delta^2)\Big|_{n\text{ odd}}\right]U(P).\end{aligned} \tag{15}$$

On the other hand are the (moments of) spin independent GPDs expressed in terms of polynomials in $\xi=-(n\cdot\Delta)/2$ and the GFFs

$$\begin{aligned}H_{n+1}(\xi,t) &\equiv \int_{-1}^{1}dx\,x^nH(x,\xi,t)=\sum_{\substack{i=0\\ \text{even}}}^{n}(-2\xi)^i A_{n+1,i}(\Delta^2)+(-2\xi)^{n+1}C_{n+1,0}(\Delta^2)\Big|_{n\text{ odd}},\\ E_{n+1}(\xi,t) &= \sum_{\substack{i=0\\ \text{even}}}^{n}(-2\xi)^i B_{n+1,i}(\Delta^2)-(-2\xi)^{n+1}C_{n+1,0}(\Delta^2)\Big|_{n\text{ odd}}.\end{aligned} \tag{16}$$

2.2 Axial vector operator

As has been observed in Ref. [10], there is no $C_{n+1,0}(\Delta^2)$-like GFF present for the axial vector, and the parameterization shown there reads

$$\langle P'|\,\bar\psi(0)\gamma_5\gamma^{\{\mu}iD^{\mu_1}\cdots iD^{\mu_n\}}\psi(0)\,|P\rangle \;=\; \overline{U}(P')\sum_{\substack{i=0\\ \text{even}}}^{n}\Big\{\gamma_5\gamma^{\{\mu}\Delta^{\mu_1}\cdots\Delta^{\mu_i}\overline{P}^{\mu_{i+1}}\cdots\overline{P}^{\mu_n\}}\tilde{A}_{n+1,i}(\Delta^2) + \gamma_5\frac{\Delta^{\{\mu}}{2m}\Delta^{\mu_1}\cdots\Delta^{\mu_i}\overline{P}^{\mu_{i+1}}\cdots\overline{P}^{\mu_n\}}\tilde{B}_{n+1,i}(\Delta^2)\Big\}U(P). \quad (17)$$

while the inverse relations are given by

$$\widetilde{H}_{n+1}(\xi,t)=\sum_{\substack{i=0\\ \text{even}}}^{n}(-2\xi)^i\,\widetilde{A}_{n+1,i}(\Delta^2),\;\; \widetilde{E}_{n+1}(\xi,t)=\sum_{\substack{i=0\\ \text{even}}}^{n}(-2\xi)^i\,\widetilde{B}_{n+1,i}(\Delta^2). \quad (18)$$

2.3 Tensor operator

For the lowest moment ($n=0$) one finds three form factors, see Ref. [2],

$$\langle P'|\,\bar\psi(0)i\sigma^{\mu\nu}\psi(0)\,|P\rangle \;=\; \overline{U}(P')\Big\{i\sigma^{\mu\nu}A_{T10}(\Delta^2) + \frac{\overline{P}^{[\mu}\Delta^{\nu]}}{m^2}\tilde{A}_{T10}(\Delta^2) + \frac{\gamma^{[\mu}\Delta^{\nu]}}{2m}B_{T10}(\Delta^2)\Big\}U(P). \quad (19)$$

Another possible structure $\propto \gamma^{[\mu}\overline{P}^{\nu]} \equiv \gamma^\mu\overline{P}^\nu - \gamma^\nu\overline{P}^\mu$ in (19) is not allowed by time reversal symmetry, but for $n=1$ this can be balanced with an additional factor Δ, leading in agreement with our counting to four generalized form factors (see also the detailed discussion in the appendix of Ref. [2]) ,

$$\underset{[\mu\nu]\{\nu\mu_1\}}{A\;S}\;\langle P'|\,\bar\psi(0)i\sigma^{\mu\nu}iD^{\mu_1}\psi(0)\,|P\rangle \;=\; \underset{[\mu\nu]\{\nu\mu_1\}}{A\;S}\;\overline{U}(P')\Big\{i\sigma^{\mu\nu}\overline{P}^{\mu_1}A_{T20}(\Delta^2) + \frac{\overline{P}^{[\mu}\Delta^{\nu]}}{m^2}\overline{P}^{\mu_1}\tilde{A}_{T20}(\Delta^2) + \frac{\gamma^{[\mu}\Delta^{\nu]}}{2m}\overline{P}^{\mu_1}B_{T20}(\Delta^2) + \frac{\gamma^{[\mu}\overline{P}^{\nu]}}{m}\Delta^{\mu_1}\tilde{B}_{T21}(\Delta^2)\Big\}U(P). \quad (20)$$

Going to $n=2$, one finds by an appropriate inclusion of factors $\overline{P}$ and Δ a total of seven GFFs

$$
\begin{aligned}
\underset{[\mu\nu]\{\nu\mu_1\ldots\}}{A\quad S} \langle P'|\, \bar\psi(0) i\sigma^{\mu\nu} iD^{\mu_1} iD^{\mu_2}\psi(0)\,|P\rangle \;=\;& \underset{[\mu\nu]\{\nu\mu_1\ldots\}}{A\quad S} \overline{U}(P')\Big\{ i\sigma^{\mu\nu}\overline{P}^{\mu_1}\overline{P}^{\mu_2} A_{T30}(\Delta^2) \\
& + i\sigma^{\mu\nu}\Delta^{\mu_1}\Delta^{\mu_2}A_{T32}(\Delta^2) \\
& + \frac{\overline{P}^{[\mu}\Delta^{\nu]}}{m^2}\overline{P}^{\mu_1}\overline{P}^{\mu_2}\tilde{A}_{T30}(\Delta^2) \\
& + \frac{\overline{P}^{[\mu}\Delta^{\nu]}}{m^2}\Delta^{\mu_1}\Delta^{\mu_2}\tilde{A}_{T32}(\Delta^2) \\
& + \frac{\gamma^{[\mu}\Delta^{\nu]}}{2m}\overline{P}^{\mu_1}\overline{P}^{\mu_2}B_{T30}(\Delta^2) \\
& + \frac{\gamma^{[\mu}\Delta^{\nu]}}{2m}\Delta^{\mu_1}\Delta^{\mu_2}B_{T32}(\Delta^2) \\
& + \frac{\gamma^{[\mu}\overline{P}^{\nu]}}{m}\Delta^{\mu_1}\overline{P}^{\mu_2}\tilde{B}_{T31}(\Delta^2)\Big\} U(P). \qquad (21)
\end{aligned}
$$

Continuing this chain of reasoning, we need as shown above a total of $2\left\lfloor \frac{n}{2}\right\rfloor + n + 3$ generalized form factors for the parameterization of the nth moment of the tensor operator

$$
\begin{aligned}
& \underset{[\mu\nu]\{\nu\mu_1\ldots\}}{A\quad S} \langle P'|\, \bar\psi(0) i\sigma^{\mu\nu} iD^{\mu_1}\cdots iD^{\mu_n}\psi(0)\,|P\rangle \\
=\; & \underset{[\mu\nu]\{\nu\mu_1\ldots\}}{A\quad S} \overline{U}(P')\Bigg[\sum_{\substack{i=0\\ \text{even}}}^{n}\Big\{ i\sigma^{\mu\nu}\Delta^{\mu_1}\cdots\Delta^{\mu_i}\overline{P}^{\mu_{i+1}}\cdots\overline{P}^{\mu_n}A_{Tn+1,i}(\Delta^2) \\
& + \frac{\overline{P}^{[\mu}\Delta^{\nu]}}{m^2}\Delta^{\mu_1}\cdots\Delta^{\mu_i}\overline{P}^{\mu_{i+1}}\cdots\overline{P}^{\mu_n}\tilde{A}_{Tn+1,i}(\Delta^2) \\
& + \frac{\gamma^{[\mu}\Delta^{\nu]}}{2m}\Delta^{\mu_1}\cdots\Delta^{\mu_i}\overline{P}^{\mu_{i+1}}\cdots\overline{P}^{\mu_n}B_{Tn+1,i}(\Delta^2)\Big\} \\
& + \sum_{\substack{i=0\\ \text{odd}}}^{n}\frac{\gamma^{[\mu}\overline{P}^{\nu]}}{m}\Delta^{\mu_1}\cdots\Delta^{\mu_i}\overline{P}^{\mu_{i+1}}\cdots\overline{P}^{\mu_n}\tilde{B}_{Tn+1i}(\Delta^2)\Bigg] U(P). \qquad (22)
\end{aligned}
$$

The polynomial relations between the generalized transversity plus the other corresponding GPDs and the GFFs are

$$
H_{T,n+1}(\xi,t) \;=\; \sum_{\substack{i=0\\ \text{even}}}^{n}(-2\xi)^i\,A_{Tn+1,i}(\Delta^2),\;\; \widetilde{H}_{T,n+1}(x,\xi,t) = \sum_{\substack{i=0\\ \text{even}}}^{n}(-2\xi)^i\,\widetilde{A}_{Tn+1,i}(\Delta^2),
$$

$$E_{T,n+1}(\xi,t) \;=\; \sum_{\substack{i=0\\ \text{even}}}^{n} (-2\xi)^i\, B_{Tn+1,i}(\Delta^2),\;\; \widetilde{E}_{T,n+1}(x,\xi,t) = \sum_{\substack{i=0\\ \text{odd}}}^{n} (-2\xi)^i\, \widetilde{B}_{Tn+1,i}(\Delta^2), \qquad (23)$$

showing explicitely that $\widetilde{E}_T(x,\xi,t)$ is the only twist-2 GPD being antisymmetric in ξ [2].

3 Summary

Based on the method presented in Ref. [7] we have counted the number of independent generalized form factors parameterizing the towers of axial vector and tensor operators, see tables (10,14). This gave us an independent check on the actual decomposition of the tensor operator, which is presented in Eq. (22). Taking together these results with the corresponding representations of the tensor operator on a space-time-lattice [12] will probably allow for a first determination of the lowest moments of the generalized transversity in lattice QCD.

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